

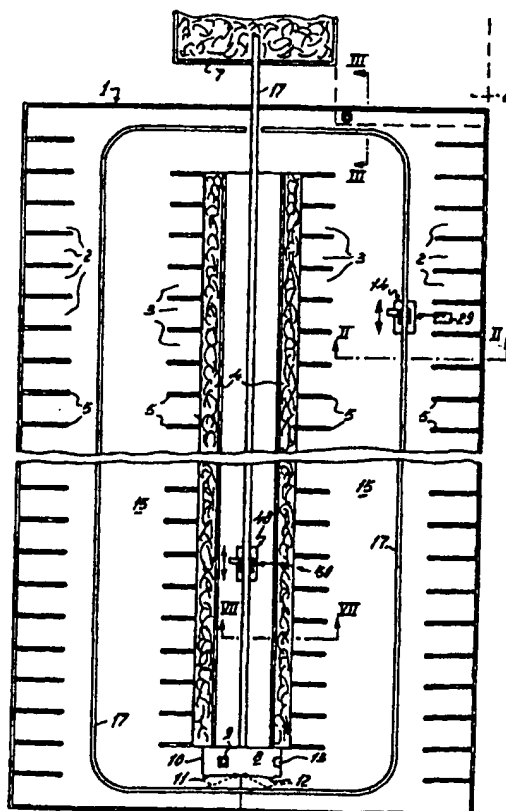
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: A CONSTRUCTION INCLUDING A SHED FOR ANIMALS

(57) Abstract

The invention relates to a construction including a shed for animals, such as cows, comprising a shed (1) and cleaning means (14) capable of being moved through the shed (1) with the aid of which cleaning means the floor (15) of the shed can be selectively cleaned. The cleaning means (14) comprise a manure suction device by means of which waste material lying on the shed floor (15) can be sucked. The construction according to the invention is further provided with gripping means (48) for picking up and/or distributing fodder in the shed (1). Thereby the gripping means (48) can be active in any place in the shed (1).



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A CONSTRUCTION INCLUDING A SHED FOR ANIMALS

5 The invention relates to a construction including a shed for animals, such as cows, comprising cleaning means capable of being moved through the shed for cleaning the floor thereof.

Such a construction is known.

The invention aims to improve the construction and to realize an environment-friendly and hygienic shed.

10 According to the invention, this will be achieved by providing the cleaning means with manure pick-up means for automatically cleaning the floor of the shed. By means of the manure pick-up means the manure can be removed very quickly and efficiently from the shed floor. This will reduce the emission of ammonia to a considerable extent.

15 In accordance with an inventive feature, the manure pick-up means comprise gripping means and/or a manure suction device and/or shovel up means. According to a further inventive feature, the manure pick-up means can be active selectively, under computer control, in any place in the shed. Due to this the excrements can be removed from the shed floor in a very short time, i.e. in a few minutes. According to an inventive feature, the manure pick-up means are movable in height so that they can be lifted over obstacles, such as animals, fences and the like. In order to ascertain where the excrements are lying on the shed floor, in accordance with an inventive feature, the cleaning means are provided with a sensor by means of which there can be determined where there is waste material on the shed floor.

25 The invention furthermore relates to a construction including a shed for animals, such as cows, comprising
30

cleaning means capable of being moved through the shed for cleaning the floor thereof, characterized in that there are provided in the shed one or more sensors by means of which there can be determined where there is manure in the shed.

5 The invention additionally relates to a method of removing manure from a shed, characterized in that there is observed by a monitoring system when and where there are deposited excrements in the shed and, as soon as this has been ascertained, the excrements are automatically removed
10 from the shed. In order to realize an effective cleaning of the shed, according to again an other inventive feature, the manure suction device is movable on the floor in a reciprocating manner.

 In accordance with a further aspect of the inven-
15 tion, the manure suction device comprises a robot arm construction which, at its upper side, is movable along a rail disposed at a certain height in the shed and which, at its lower side, is provided with a nozzle. The robot arm construction can be moved along the rail through the entire
20 shed. According to a further inventive feature, the robot arm construction is constituted by a container that is movable along the rail, which container includes a manure pump and at least two pivotable arms, of which the lower one is provided with the nozzle. In accordance with an inventive feature, the
25 container comprises a compartment for the manure and a compartment for the cleaning and/or spraying and/or disinfecting fluid. In order to guarantee a proper cleaning of the shed floor, according to an inventive feature, the manure is discharged by an arm of the robot arm construction to the manure
30 compartment, and the cleaning and/or spraying and/or disinfecting fluid is supplied by the other arm of the robot arm construction to a spraying device in the nozzle. In accordance with again an other aspect of the invention, the nozzle is additionally provided with wheels so that it can easily be
35 moved on the shed floor. According to the invention, the nozzle further comprises at least one motor-driven cleaning element, such as a brush. For the purpose of discharging the manure collected in the manure compartment, in accordance with an inventive feature, the construction comprises manure

discharge means with the aid of which the manure can be discharged into a manure storage tank, while there are further provided fluid supply means with the aid of which cleaning and/or spraying and/or disinfecting fluid can be supplied to the fluid compartment in the container. According to an inventive feature, the manure discharge means comprise a manure discharge line, which is capable of being connected to the container of the robot arm construction, as well as a manure pump. For the purpose of connecting the manure discharge line and a fluid supply line to the container, according to an inventive feature, the manure discharge means and the fluid supply means comprise coupling means.

In order to be able to avoid obstacles in the vicinity of the robot arm construction, according to an inventive feature, the cleaning means are provided with detection means.

The invention further relates to a construction including a shed for animals, such as cows, comprising cleaning means capable of being moved through the shed for cleaning the floor thereof, characterized in that, for the transport of goods, such as hay, soilage and/or manure, the construction comprises gripping means, such as one or more crane systems, which are capable of swerving automatically when there is a cow on the path of one of these crane systems.

In accordance with a further inventive feature, the construction is provided with gripping means for picking up fodder. Therefore, the invention further relates to a construction including a shed for animals, such as cows, characterized in that the construction is provided with gripping means for picking up fodder. Fodder can be automatically transported with the aid of the gripping means e.g. from a silo to the feed stands. Therefore, in accordance with the invention, the gripping means can be active selectively in any place in the shed and, according to a further inventive feature, the gripping means are movable in height. In accordance with again an other inventive feature, the gripping means are provided with a sensor by means of which there can be determined whether there is fodder on the shed

floor. Furthermore, according to the invention, the height and/or the distribution of the fodder on the shed floor can be determined by means of the sensor. When the fodder has been distributed irregularly, then, by means of the gripper, the fodder can be automatically distributed equally over the feed stands.

According to a further aspect of the invention, the gripping means comprise a robot arm construction, which, at its upper side, is movable along a rail disposed at a certain height in the shed and which, at its lower side, is provided with a gripper. The robot arm construction is constituted by a carrier, that is movable along the rail, and at least two pivotable arms, of which the lower one is provided with the gripper. According to a further inventive feature, the sensor for determining the distribution as well as the height of the fodder is arranged on the carrier of the robot arm construction.

In accordance with an inventive feature, the construction comprises a feed silo from which fodder can be transported by the gripping means to the feed alley. Additionally, according to the invention, along the feed alley there can be provided sensors by means of which the height and/or the distribution of the fodder can be determined.

In a preferred embodiment, the shed is constructed as a loose house having a capacity of approximately hundred animals. For the purpose of automizing the shed, according to an inventive feature, the cleaning means and/or the gripping means are computer-controlled. According to an other inventive feature, the construction comprises a milking robot.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 shows, in plan view, a construction including a shed, in which there are provided cleaning means for cleaning the shed floor, as well as gripping means for picking up fodder;

Figure 2 shows a side view of a manure suction device, taken on the line II-II in Figure 1;

Figure 3 shows the manure suction device, according to the line III-III in Figure 1;

Figure 4 is an enlarged view of a nozzle of the manure suction device, according to Figures 1 to 3;

5 Figure 5 is a side view of the nozzle, according to Figure 4;

Figure 6 shows a bottom view of the nozzle, according to Figure 4;

10 Figure 7 shows gripping means for picking up fodder, according to the side view as indicated by the line VII-VII in Figure 1.

Figure 1 shows, in plan view, a shed 1, provided on both sides with a row of cubicles 2 and in the middle with two rows of feed stands 3 including feed grooves 4. Both the
15 cubicles 2 and the feed stands 3 are mutually separated by means of fencings 5.

Besides the shed 1, the construction further comprises a dung-pit 6 and a feed silo 7. Additionally, at one end of the feed stands 3 there is arranged a milking
20 robot 8, by means of which teat cups 9 can be automatically connected to the teats of an animal to be milked. The milking robot 8 is disposed near a milk box 10, which is provided with an entrance door 11 and an exit door 12. The milk box 10 further comprises a manger 13, in which concentrate can be
25 supplied to the animal.

In the shed 1 there are furthermore provided cleaning means 14 for cleaning the shed floor 5. The cleaning means 14 comprise a robot arm construction 16 (Figure 2), which is movable through the shed 1 underneath a rail 17. As
30 shown in Figure 2, the rail 17 is constituted by an I-profile, which is fitted to a roof 18 of the shed 1. The rail 17 extends in the form of a rectangle over the entire shed 1 and is located between the feed stands 3 and the cubicles 2.

35 As shown in Figure 2, the robot arm construction 16 comprises a container 19 accommodating a manure pump 20, one compartment 21 for the storage of manure and one compartment 22 for the storage of a cleaning and/or spraying and/or disinfecting fluid. At the upper side of the container 19

there is disposed a U-beam 23, which is provided on both sides with one pair of roller elements 24 located at some distance from each other. The distance at which the roller elements 24 are apart from one another corresponds to the thickness of the I-profile of the rail 17. In this manner the roller elements 24 constitute a guide means for the robot arm construction 16 along the rail 17. One roller element 24 can be driven by an electromotor 25, preferably constituted by a step motor, which is drivable in two directions. With the aid of the electromotor 25 the robot arm construction 16 can be moved through the shed.

At the lower side of the container 19 there are provided two pivotable arms 26, constituted by two interconnected parallelogram arm constructions. The parallelogram arm constructions 26 are mutually pivotable about shafts 27, while they are pivotable about shafts 28 relative to the container 19. Near the end of the lower parallelogram arm construction 26 there is disposed a nozzle 29 for sucking waste material, such as manure. The nozzle 29 is also pivotable about shafts 30 relative to the parallelogram arm construction 26 (Figure 4). The arms of the parallelogram arm constructions 26 are designed such that via one side of the parallelogram arm construction cleaning and/or spraying and/or disinfecting fluid can be supplied to the nozzle 29, while via the other side of the parallelogram arm constructions manure sucked by the nozzle 29 can be discharged to the compartment 21.

The nozzle 29 has a substantially rectangular shape and is provided at its lower side 31 with a row of brush hairs 32. At one longitudinal side and at the two ends, the nozzle 29 is further supported by wheels 33, the arrangement being such that the brush hairs 32 just do not touch the shed floor 15 (Figure 5). Near the other longitudinal side of the nozzle 29 there are additionally disposed four juxtaposed motor-driven round brushes 34. The round brushes 34 rotate in pairs in the direction of rotation indicated by the arrows 35 and 36 in Figure 6. The two middle brushes 34, of which one rotates clockwise and the other one rotates in the opposite direction, deposit the swept up waste material above an

opening 37 of the manure discharge line 38. The cleaning and/or spraying and/or disinfecting fluid supplied via the supply line 39 is sprayed over the brushes 34 by a (non-shown) spraying device. During cleaning the hairs of the brushes 34 just touch the shed floor 15.

To a side wall of the container 19 there are further provided detection means 40 comprising a sensor 41 by means of which obstacles in the vicinity of the robot arm construction 16 can be detected. The sensor 41 can e.g. be designed as a camera. During cleaning of the shed floor 15 the nozzle 29 is moved in a reciprocating manner on the shed floor 15 (dashed line in Figure 2). Furthermore, the robot arm construction 16 is each time shifted a bit along the rail 17, so that each time a strip of the shed floor 15 can be cleaned. Additionally, there can be determined by means of the sensor 41 where the excrements are lying on the shed floor 15. In this manner the robot arm construction 16 is capable of cleaning very selectively the shed floor 15. Additionally, it is possible to clean the entire shed floor 15 with the aid of the robot arm construction 16, e.g. after a determined interval of time or when the animals are in a meadow.

Near the dung-pit 6 there is furthermore provided in the shed a manure discharge line 42 which debouches into the dung-pit 6. In the manure discharge line 42 there is included a manure pump 43, by means of which manure collected in the manure compartment 21 can be pumped into the dung-pit 6. Near its upper end the manure discharge line 42 is provided with a flexible tube 44 which, with the aid of coupling means 45, can be introduced into the manure compartment 21 and be removed therefrom. The coupling means 45 comprise a pneumatically operated cylinder 46 capable of pivoting an arm 47 which is connected with the manure discharge line 42. Additionally, there is provided in the vicinity of the manure discharge line 42 a (non-shown) supply line including coupling means with the aid of which the fluid compartment 22 can be replenished with cleaning and/or spraying and/or disinfecting fluid.

The construction according to the invention is

furthermore provided with gripping means 48 for picking up fodder. Like the cleaning means 14, the gripping means 48 are capable of being used in any place in the shed 1. The gripping means 48 also comprise a robot arm construction 49 corresponding to a large extent to the robot arm construction 16 of the cleaning means 14. Therefore, corresponding parts are designated by the same reference numerals and consequently will not be described in detail. The rail 17 along which the robot arm construction 49 can be moved is also fitted to the roof 18 of the shed 1, more in particular in the centre thereof, and extends from the feed silo 7 until the milk box 10. The lower parallelogram arm construction 26 of the robot arm construction 49 is provided with a gripper 50 comprising two curved tines 51, which are pivotable about the shafts 30 by means of a (non-shown) cylinder. The gripper 50 is capable of providing both feed grooves with fodder. The upper parallelogram arm construction 26 is connected with the U-beam 23 by means of a carrier 52. On the beam 52 there are further disposed detection means 53 comprising a sensor 54 by means of which the height and/or the distribution of the fodder in the feed groove 4 can be detected. With the aid of the sensor 54 there can further be ascertained whether there are obstacles in the vicinity of the robot arm construction 49. On the container 19 and the carrier 52 there are furthermore provided computers 55 by means of which the components of the manure pick-up means, such as the electromotor 25, the cylinders of the pivotable arms 26, the drive of the brushes 34, the detection means 40 and 53, the manure pumps 20 and 43, the cylinder 46, etc. can be automatically controlled. In a (non-shown) computer the height as well as the distribution of the fodder in the feed groove 4 can be programmed, so that the fodder is automatically distributed by means of the gripping means 48. In a (non-shown) embodiment, along the feed groove there are additionally provided four sensors by means of which the height and/or the distribution of the fodder can be determined so that, on the basis of these data, the gripping means 48 can be post-controlled.

CLAIMS

1. A construction including a shed for animals, such as cows, comprising cleaning means (14) capable of being moved through the shed (1) for cleaning the floor (15) thereof, characterized in that the cleaning means (14) comprise manure pick-up means for automatically cleaning the floor of the shed.
2. A construction as claimed in claim 1, characterized in that the manure pick-up means comprise gripping means and/or a manure suction device and/or shovel up means.
3. A construction as claimed in claim 1 or 2, characterized in that the manure pick-up means can be active selectively, under computer control, in any place in the shed.
4. A construction as claimed in any one of the preceding claims, characterized in that the manure pick-up means are movable in height.
5. A construction as claimed in any one of the preceding claims, characterized in that the implement is provided with detection means (40) with the aid of which there can be determined whether there is waste material, such as manure, on the shed floor (15).
6. A construction including a shed for animals, such as cows, comprising cleaning means (14) capable of being moved through the shed (1) for cleaning the floor (15) thereof, characterized in that there are provided in the shed (1) one or more sensors by means of which there can be determined where there is manure in the shed (1).
7. A construction as claimed in any one of the preceding claims, characterized in that the manure suction device is movable on the shed floor (15) in a reciprocating manner.
8. A construction as claimed in any one of the preceding claims, characterized in that the manure suction device comprises a robot arm construction (16) which, at its upper side, is movable along a rail (17) disposed at a certain height in the shed (1) and which, at its lower side, is provided with a nozzle (29).

9. A construction as claimed in any one of the preceding claims, characterized in that the robot arm construction (16) is constituted by a container (19) movable along the rail (17), which container (19) includes a manure pump (20) and at least two pivotable arms (26), of which one is provided with the nozzle (29) for sucking the manure.

10. A construction as claimed in claim 9, characterized in that the implement comprises a container (21) for manure and a container (22) for cleaning and/or spraying and/or disinfecting fluid.

11. A construction as claimed in claim 9 or 10, characterized in that the manure is discharged by an arm of the robot arm construction (16) to the manure compartment (21), and the cleaning and/or spraying and/or disinfecting fluid is supplied by the other arm of the robot arm construction to a spraying device in the nozzle (29).

12. A construction as claimed in any one of claims 8 to 11, characterized in that the nozzle (29) is provided with wheels (33).

13. A construction as claimed in any one of claims 8 to 12, characterized in that in the nozzle (29) there is provided at least one motor-driven cleaning element (39), such as one or more brushes.

14. A construction as claimed in any one of the preceding claims, characterized in that the construction comprises manure discharge means with the aid of which manure collected by the manure suction device can be discharged into a manure storage tank (6), as well as fluid supply means with the aid of which cleaning and/or spraying and/or disinfecting fluid can be supplied to the container (19).

15. A construction as claimed in claim 14, characterized in that the manure discharge means comprise a manure discharge line (42), capable of being connected to the container (19) of the robot arm construction (16), as well as a manure pump (43).

16. A construction as claimed in claim 15, characterized in that the manure discharge means and the fluid supply means comprise coupling means (45) by means of which the manure discharge line (42) and a fluid supply line can be

connected to the container (19).

17. A construction as claimed in any one of the preceding claims, characterized in that the cleaning means are provided with detection means (53) for detecting obstacles in the vicinity of the robot arm construction (16).

18. A construction including a shed for animals, such as cows, comprising cleaning means (14) capable of being moved through the shed (1) for cleaning the floor (15) thereof, characterized in that, for the transport of goods, such as hay, soilage and/or manure, the construction comprises gripping means, such as one or more crane systems, which are capable of swerving automatically when there is a cow on the path of one of these crane systems.

19. A construction as claimed in any one of the preceding claims, characterized in that the construction is provided with gripping means (48) for picking up fodder.

20. A construction including a shed for animals, such as cows, characterized in that the construction is provided with gripping means (48) for picking up fodder.

21. A construction as claimed in claim 19 or 20, characterized in that the gripping means (48) can be active selectively in any place in the shed (1).

22. A construction as claimed in any one of claims 19 to 21, characterized in that the gripping means (48) are movable in height.

23. A construction as claimed in any one of claims 19 to 22, characterized in that the gripping means (48) are provided with detection means (53) by means of which there can be determined whether there is fodder on the shed floor (15).

24. A construction as claimed in claim 23, characterized in that by means of the detection means (53) the height and/or the distribution of the fodder on the shed floor (15) can be determined.

25. A construction as claimed in any one of claims 19 to 24, characterized in that the gripping means (48) comprise a robot arm construction (16) which, at its upper side, is movable along a rail (17) disposed at a certain height in the shed (1) and, at its lower side, is provided with a grip-

per (50).

26. A construction as claimed in claim 25, characterized in that the robot arm construction (16) is constituted by a carrier (52) movable along the rail (17), and comprises at least two pivotable arms, of which the lower one is provided with the gripper (50).

27. A construction as claimed in any one of claims 19 to 26, characterized in that the detection means (53) for determining the distribution and/or the height of the fodder are arranged on the carrier (52) of the robot arm construction (16).

28. A construction as claimed in any one of claims 19 to 27, characterized in that the construction comprises a feed silo (7) from which the fodder can be transported by the gripping means (48) to a feed alley.

29. A construction as claimed in any one of claims 19 to 28, characterized in that along the feed alley there are provided detection means by means of which the height and/or the distribution of the fodder can be determined.

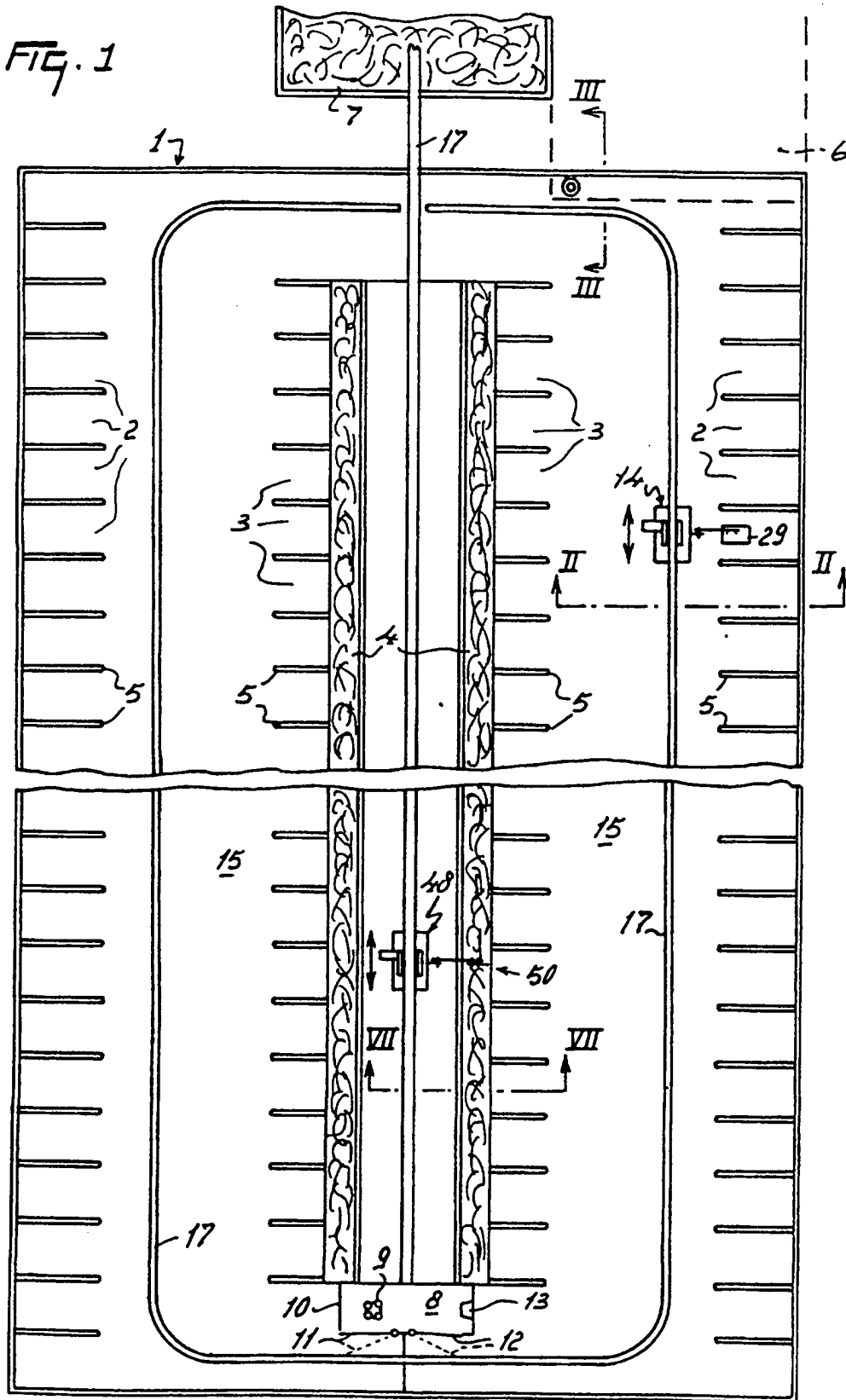
30. A construction as claimed in any one of the preceding claims, characterized in that the shed (1) is constructed as a loose house having a capacity of approximately hundred animals.

31. A construction as claimed in any one of the preceding claims, characterized in that the cleaning means (19) and/or the gripping means (48) are computer-controlled.

32. A construction as claimed in any one of the preceding claims, characterized in that the construction comprises a milking robot (8).

33. A method of removing manure from a shed, characterized in that there is observed by a monitoring system when and where there are deposited excrements in the shed and, as soon as this has been ascertained, the excrements are automatically removed from the shed.

FIG. 1



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FIG. 2

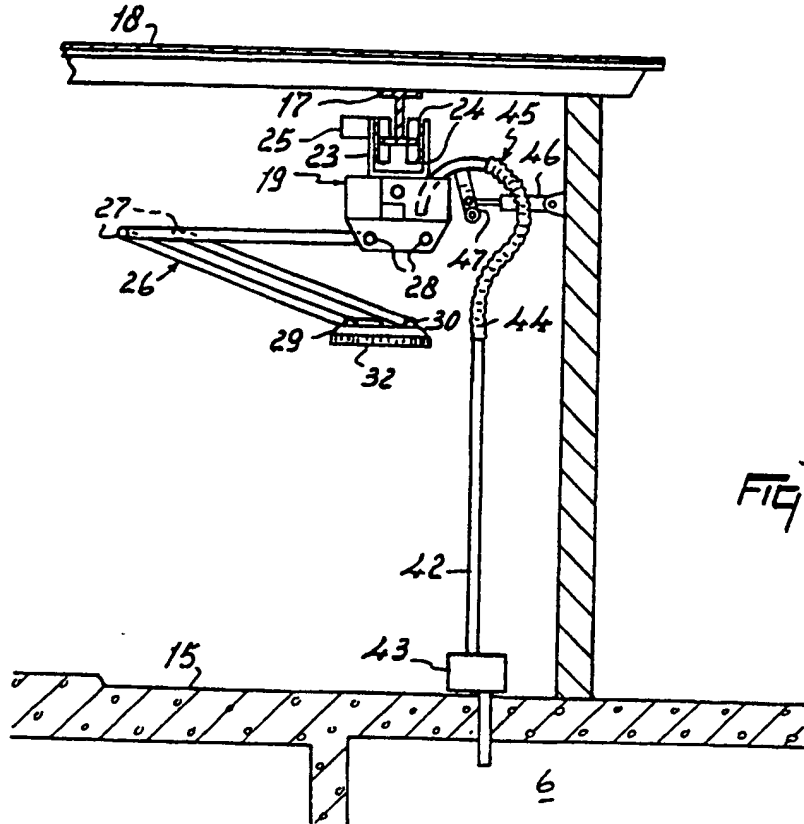
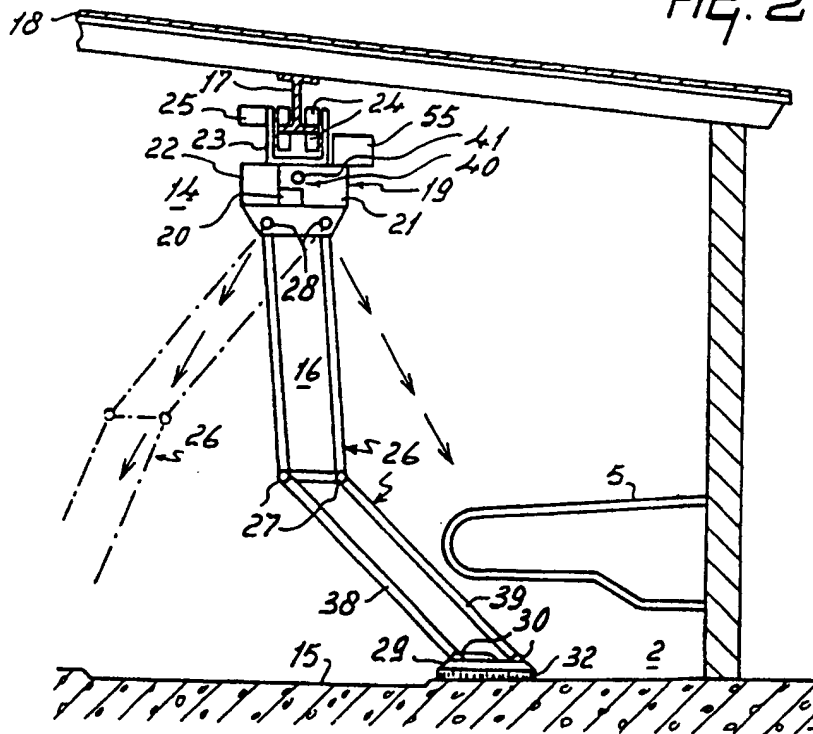
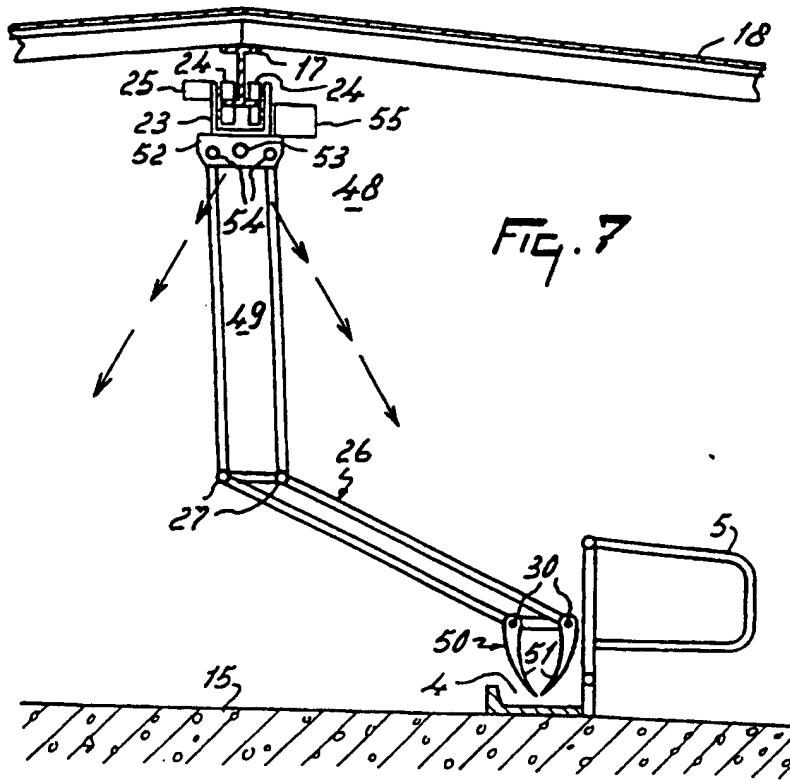
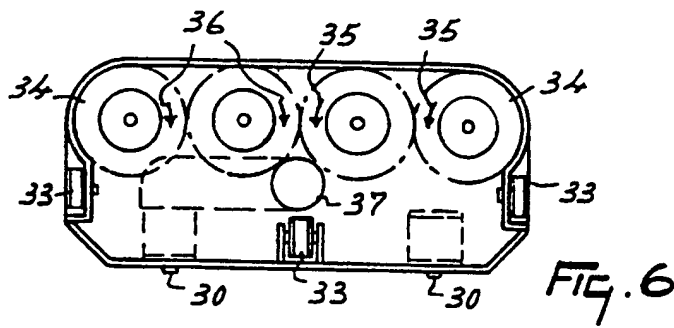
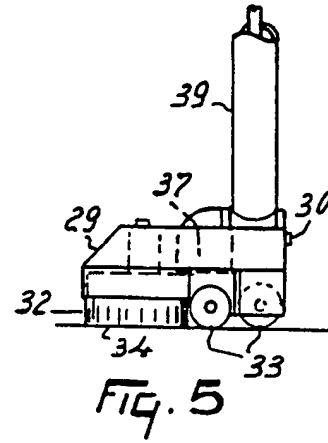
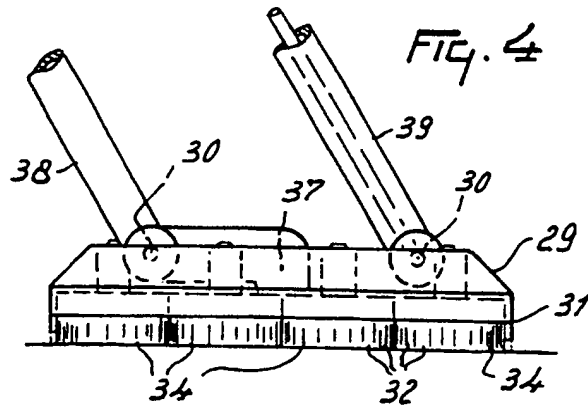


FIG. 3

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INTERNATIONAL SEARCH REPORT

International application No

PCT/NL 97/00082

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A01K1/01 A01K5/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A01K B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	EP 0 473 051 A (IRPS) 4 March 1992 see column 3, line 19-35; figure 1 ---	1,30 3,31
A	EP 0 400 304 A (VON DER HEIDE) 5 December 1990 see the whole document ---	1,2,4,7, 10,14,15
A	FR 2 586 405 A (HIRET) 27 February 1987 see claim 1 ---	1,5
A	DE 39 32 034 A (AUSTERMÜHLE) 4 April 1991 see the whole document ---	1,2,4, 10,17
A	NL 8 006 788 A (INTERNATIONAL PROJECT AGENCY B.V.) 1 July 1982 see page 7, line 27 - page 8, line 22; figures 4,6 ---	2-4
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

17 April 1997

Date of mailing of the international search report

05.08.97

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/NL 97/00082

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 91 04656 A (KANGAS) 18 April 1991 ---	
A	GB 2 238 564 A (SHREEVE) 5 June 1991 ---	
A	FR 2 632 518 A (MERLANDE) 15 December 1989 ---	
A	NL 301 249 A (MEUWISSEN) 27 September 1965 ---	
A	NL 8 703 037 A (TYH-YUAN HOUR) 17 July 1989 -----	

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INTERNATIONAL SEARCH REPORT

Inter national Application No.

PCT/NL 97/ 00082

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see annex

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (1)) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No. PCT/NL 97/00082

FURTHER INFORMATION CONTINUED FROM PCT/ISA/210

SEARCHED

Group 1: Independent claim 1, claims 2 to 5, and claims 7 to 17, 19 and 21 to 32, as far as related to claim 1: "Construction including a shed for animals with cleaning means for automatically cleaning the floor of the shed".

NOT SEARCHED

Group 2: Independent claims 6 and 33 and claims 7 to 17, 19 en 21 to 32, as far as related to claim 6: "Construction including a shed for animals with one or more sensors for the detection of manure en method for manure removal by means of a manure monitoring system".

NOT SEARCHED

Group 3: Independent claim 18 and claims 19 and 21 to 32, as far as related to claim 18: "Construction including a shed for animals with gripping means which are capable of swerving automatically for a cow".

NOT SEARCHED

Group 4: Independent claim 20, and claims 21 to 32, as far as related to claim 20: "Construction including a shed for animals with gripping means for picking up fodder".

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/NL 97/00082

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